OREGON FUEL INJECTION, INC.
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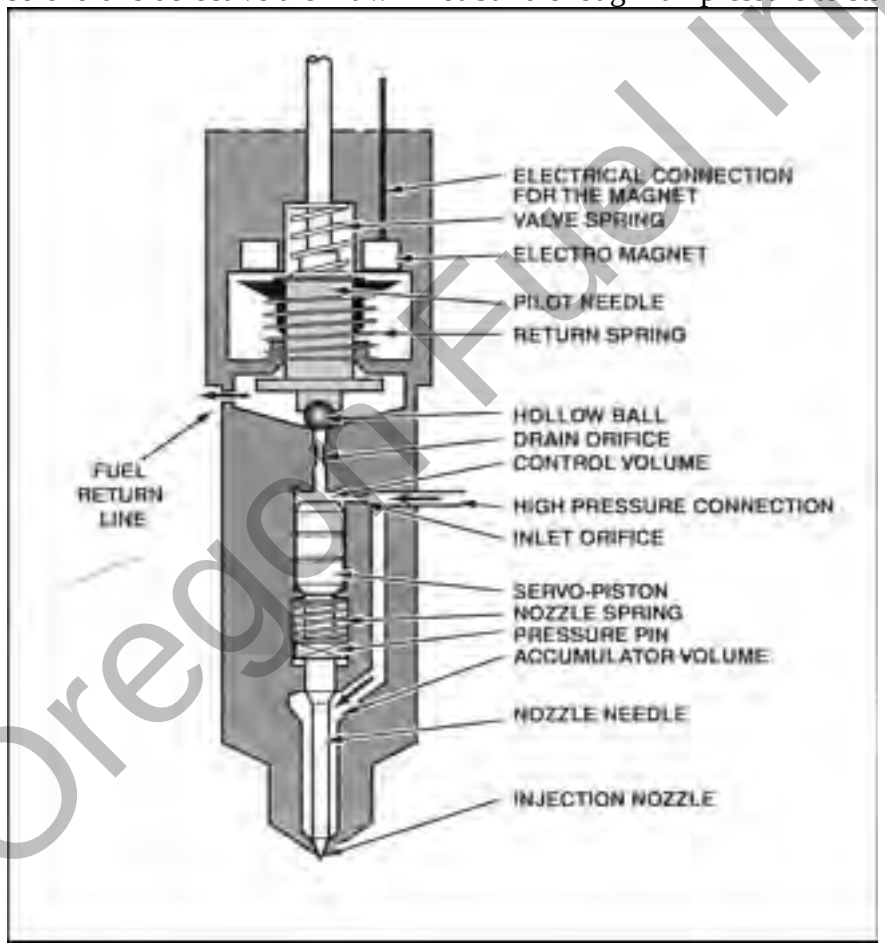
http://oregonfuelinjection.com

2001– 2006 Dodge – Mercedes - Freightliner Sprinter Diagnostics

In order to do proper diagnostics you will need a scan tool and some special tools available from Mopar Special Tools http://mopar.snapon.com .

High Pressure Common Rail Basic Information

The high pressure pump builds the high pressure and delivers it to the fuel rail manifold, which buffers out pressure fluctuations and distributes fuel to the individual injectors. The fuel quantity valve (fuel control actuator, M-Prop) in the high pressure pump controls pressure output from the pump. The fuel pressure solenoid (pressure control valve) in the fuel rail has final control of rail pressure and prevents over pressurizing of the system. The injectors have a hollow check ball that holds rail pressure until the fuel solenoid is actuated by the ECM, this allows the check ball to rise off its' seat and an injection to take place. If the check ball in the injector is leaking or the fuel pressure solenoid is defective then it will not build enough rail pressure to start the engine.



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CAUTION

The fuel system contains high pressure fuel up to 23,500 PSI. Do Not use your fingers to find leaks! High pressure fuel entering your bloodstream may result in amputation or loss of life.

Preliminary checks

1. Record and repair any active DTC, they may be related to complaint
2. Ensure that you have a good clean fuel supply.
3. Verify that battery voltage is above 12.0 volts.
4. Verify that cranking speed is above 200 rpm

No Start or Hard Start

1. No or low fuel supply pressure to the high pressure injection pump (CP3).
2. Injectors; monitor rail pressure and see if you have over 3600 PSI during cranking, if not, one or more injectors can cause a hard start, see injector section for further diagnostics. No smoke from the tailpipe after about 10 seconds of cranking means no fuel is getting into the cylinders.
3. Plugged fuel filter
4. Leaking fuel pressure solenoid (in fuel rail) there should be no fuel coming out of the solenoid while cranking, perform the fuel rail pressure solenoid leak quantity test to determine if it is faulty. If the injectors check good, the fuel pressure solenoid should hold 870-1450 psi when unplugged during cranking.
5. CMP or CKP Sensors must be in sync.

Black Smoke

1. Dirty air filter
2. Exhaust leaks or Boost leaks, you can usually hear a boost leak as a high pitched squeal under load.
3. VGT turbo sticking and/or not operating properly.
4. EGR system fault. Usually this will set a code.
5. Dirty or damaged Mass Air Flow sensor

Miss, Rough Run, Knock

1. A bad or incorrect torque on an injector, missing or damaged chamber gasket, low compression, excessive valve lash, flat lobes on camshafts could all cause a miss.
2. Injector hold down bolts must be replaced if they are removed, they are a torque to yield bolt. If not they could stretch and cause compression to blow past the injector, which can overheat the injector and cause it to fail.
3. There is a relative compression test available using the DRB3 or wiTECH scan tools. Acceptable values between two cylinders must be equal to or less than 15 rpm.

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4. There has been some issues with the harmonic balancer which may cause rough running at different RPM, leaking crank seals, some sensor issues. 01-05 model years.

Surge at idle

1. Restricted or aerated fuel supply to the high pressure pump.
2. Actual versus desired too far apart, map the fuel pressure graph, if you have a fluctuation over 500 psi this may cause a surge. It may may be a bad fuel quantity solenoid valve (FCA). Verify fuel pressure solenoid operation before replacing the fuel quantity solenoid in the high pressure pump.

Slow Deceleration

If the engine hangs at higher rpm or is slow to decelerate, injector wear is what normally causes this problem due to excessive return. Injectors will need to be replaced.

Blue-White smoke at idle when cold

If the smoke clears in less than 1 minute, this could be normal depending on temperature and altitude. Blue white smoke that burns your eyes is UN-burnt fuel. Cold temperatures, high altitude and excessive idle time all mean incomplete combustion.

1. Possible bad injector, leaking at the nozzle tip.
2. The intake air temperature, coolant temperature, inlet air temperature and battery temperature should all display normal ambient temperatures when cold. If not, repair as necessary.
3. Check glow plug system operation when cold.
4. Check rail pressure when engine is off, it should be 0 PSI (+/- 500 PSI).
5. Aerated or restricted fuel supply.
6. Excessive idle time can cause white smoke when cold due to carbon build up on injector tips. More than 20% idle time is excessive.

Fuel Supply

1. 2001-2003, use a mechanical supply pump on the front of the head to supply fuel to the CP3 pump. Cranking fuel pressure 6-22 psi, Idle 29-36 psi, and maximum pressure 51 +/- 7 psi.
2. 2004-2006 model years use an electric supply pump in the tank to feed the CP3 pump at 58 to 80 psi. Minimum pressure is 58 psi, measure before and after the fuel filter to verify any possible filter restrictions. The fuel pressure relief valve (cascade overflow valve), in the CP3 pump, limits the fuel supply pressure to the fuel quantity control valve. The pressure relief valve should open at 72.5 psi.

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Fuel Pressure Solenoid, In Fuel Rail

1. The fuel pressure solenoid is attached to the rear of the fuel rail. The tip of the fuel pressure solenoid uses a knife edge, for metal to metal sealing. The knife edge actually deforms the metal in the fuel rail in order to seal the surfaces. The solenoid must be replaced if it is removed from the rail. The solenoid controls and maintains the rail pressure as commanded by the ECM.
2. In a DE-energized state, the fuel pressure solenoid is closed. During starting the fuel pressure solenoid is held closed by magnetic force. When checking the fuel pressure solenoid there should be no fuel coming out the return during cranking, and it should hold 870-1450 psi when unplugged during cranking. If it doesn't, and the injectors are OK, then the fuel pressure solenoid is bad.
3. When driving, the fuel pressure solenoid is constantly open, the pressure of the fluid counteracts the magnetic force of the coil and the slight spring force to help maintain desired rail pressure.
4. If the actual fuel pressure, vs the fuel pressure set point, gradually drops and then spikes well above the set point then the fuel pressure solenoid is sticking and usually needs replaced.

High Pressure Injection Pump (CP3 Pump)

1. Most starting problems due to low rail pressure are caused by bad (check ball seat) injectors or the fuel pressure solenoid in the fuel rail. You can unplug the fuel quantity control valve, in the CP3 and the pressure should default to maximum (23,500 PSI). However, if there is a leak in the injection system then the pump will not build enough pressure. If there has been a major contamination issue with dirt and or water then it is very likely that the high pressure pump will need to be replaced. The injectors are typically damaged first, but any contamination that got into the injectors also went through the CP3 pump.
2. If the cascade over flow valve is bad this can send fuel out the return line instead of to the charging circuit of the CP3 pump.
3. If the engine is running, there is a "Pump Pressure Generation Test" available using the DRB3. Rail pressure should increase from about 5800 psi to about 20,305 psi in about two seconds. If it does not, there is likely a high pressure fuel system problem, provided that the injectors and fuel pressure solenoid have been tested and are good.

Injectors

***The injector hold down bolts are torque to yield. They must be replaced when removed, they are one time use only! If they are not replaced it will most likely lead to the the injectors coming loose while running, and possible damage to the cylinder head.**

It takes about 3600 PSI rail pressure in order for the injectors to deliver fuel for starting.

1. Excessive leakage in the injector usually results in a starting issue, which could occur hot or cold, but usually occurs hot because the fuel is thinner when hot.

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Excess leakage from the injector is returned to the tank, it is not an external fuel leak.

2. Per Chrysler, unplug the cam sensor and fuel rail pressure solenoid, and plumb the individual injector returns in to graduated vials. Run the cranking Fuel Quantity Test with a scan tool. In 10 seconds of cranking the return should be no more than 2.5 ml per injector. If more than 2.5 ml, replace the injector, clear the memory using the scan tool and retest. Multiple failures are possible, because hydraulic flow will take the path of least resistance.
3. You can also perform the engine running Fuel Quantity Test. After 10 seconds a maximum of 40 ml is allowed, if more replace the bad injector, clear the memory and rerun the test. See the service manual for more information.
4. The injectors can be very difficult to remove at times due to carbon build up around the injector body in the cylinder head. Usually this is caused by leaking chamber gaskets. The hold down bolts are marginal at best, and if re-used after removal they will not hold torque. The bolts are torque to yield, they must be replaced any time they are removed.

Turbocharger

The turbochargers on these engines are a variable geometry type turbo. They use an electric actuator, controlled by a pulse width modulated signal from the ECM, to vary vane position depending on load and throttle position. Like any of the other VGT type turbos, these turbos are susceptible to carbon build up causing the vanes to stick resulting in several drivability problems. Most commonly these complaints would include poor response, low power, black smoke, and poor fuel economy, among others. The turbocharger, charge air cooler and EGR system operate with one another and must be tested as a system.

1. Run the turbo actuator test with the DRB3. If the actuator rod does not move at all or does not move evenly inspect the pivot where the rod connects to the vane lever. They tend to corrode and limit movement. Clean up the pivot and rod, apply high temp grease and retry. If it still does not move correctly and the electrical power supply and ground check OK, then the turbo needs replaced. The actuator can not be replaced separately from the turbo.
2. Note: Do no try and move the actuator rod externally by pushing or pulling on it. The actuator rod has a worm rive gear attached to it which does not allow movement from the output side.

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Use the following information regarding diagnostic trouble codes in addition to the normal diagnostic procedures outlined in the service manual or technical service bulletins.

DTC P0087 Fuel rail pressure malfunction- pressure too low
*This code is not listed in Chrysler service literature for Sprinter but may set or show with some scan tools.

1. Restricted or aerated fuel supply to CP3 pump
2. Excessive leakage from fuel injectors
3. Fuel pressure solenoid in fuel rail not operating correctly

DTC P0201 – P0205 Injector control circuit

1. Damaged injector wiring
2. Check injector resistance, should be less than 1 ohm and greater than zero ohms (zero ohm meter leads before test).

DTC P0299 Turbo under boost condition
*This code is not listed in the Chrysler service information for Sprinter, but it is an OBD2/Global code that can be stored in the Sprinter ECM and will show with some scan tools, often in conjunction with P2359.

1. Cracked and/or leaking plastic turbocharger resonator
2. Cracked and/or leaking charge air cooler tube from intercooler to intake
3. Dirty or Damaged MAF sensor
4. Other boost leaks and or exhaust leaks (before the turbocharger)
5. Turbo and or VGT system failure- VGT actuator stuck open
6. EGR valve sticking or other EGR system failure
7. Plugged air filter, 2004-2006 air filters should not have a foam pad glued to them.
8. Plugged catalytic converter

DTC P0300 Misfire detected

1. Restricted or aerated fuel supply
2. Defective injector(s)
3. Fuel injector hold down lost torque, chamber gasket leaking
4. Use scan tool to isolate each cylinder
5. Perform Fuel Correction Test with scan tool to isolate cylinders
6. Damaged cams and/or lifters

DTC P2025 Intake pressure sensor plausibility

1. Basically barometric pressure/intake restriction sensor. Mounted on air box and is often damaged during service or other repairs

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DTC P02043 Camshaft position sensor circuit- open circuit

1. Usually defective cam sensor, however occasionally a bad crank sensor may set this code.
2. Often sets in conjunction with P2045 crankshaft position sensor circuit lost signal

DTC P02045 Crankshaft position sensor circuit lost signal

1. Usually defective cam sensor, however occasionally a bad crank sensor may set this code.
2. Often sets in conjunction with P2043 camshaft position sensor circuit- open circuit

DTC P2359 Boost pressure too high/too low

1. Most commonly set due to a cracked and/or leaking turbocharger resonator assembly.
2. Other boost leaks at intercooler, intercooler piping, etc.
3. Sticking VGT actuator
4. Plugged air filter, 2004-2006 air filters should not have a foam pad glued to them.
5. Restricted exhaust
6. Defective turbocharger

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